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CITY PLANNING CONSIDERATIONS
IN THE DEVELOPMENT OF RAPID TRANSIT IN METROPOLITAN AREAS

A THESIS

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IN THE DEVELOPMENT OF RAPID TRANSIT IN METROPOLITAN AREAS

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SUMMARY

The purpose of this study is to present and analyze the city planning considerations that should be taken into account in planning for rapid-transit facilities.

The main questions examined in the thesis are: the role of rapid transit as a means of transportation, rapid transit as a tool for guiding city growth, and the organizational and financial aspects of rapid-transit development.

To utilize fully the potential of rapid transit as a passenger-carrying medium, these facilities must be coordinated with the automobile, local transit, and commuter transportation. Suggestions to help bring about such coordination are presented on the basis of the experience of existing systems.

Rapid transit, however, does more than move people. It has a powerful effect on the patterns of land use and population distribution. These effects on residential, commercial, and industrial districts are studied, and recommendations are made for the use of rapid transit in accomplishing sound urban development objectives. The surveys and studies needed preparatory to the development of a rapid-transit network are discussed, as well as the importance of over-all community goals for the metropolitan area. Only with an area development plan to guide the location of

lines and stations can a system be properly developed.

The third chapter of the thesis is devoted to an analysis of the District and Authority as proprietary agencies for rapid-transit development and operation. From the information available, the Authority appears to be particularly suitable for this purpose because of its relatively greater freedom of action.

CHAPTER I

INTRODUCTION

Rapid transit is public passenger transportation operated on an exclusive right-of-way. It cannot be considered solely as a means of moving people, for the very location and nature of a rapid-transit system have a powerful effect on the entire urban community. The transportation problem is not just an engineering problem within a geographic framework; it has important political, economic, and social effects.

The prime objective of this study is to make recommendations as to how a rapid-transit system may be planned to aid in the accomplishment of sound urban development.

The problem of the movement of people is common to all large urban concentrations. Increase of population and of area leads to wide separation of functions and a constant increase in the need for movement. In metropolitan areas the problem has been compounded by two additional factors: extremely rapid growth and numerous political jurisdictions, which make over-all long-range planning difficult.

"As yet no American city has devised and constructed a mass transportation system geared to the needs and requirements of the modern metropolitan community now in

process of formation."[1] A number of metropolitan areas at one time or another have contemplated construction of rapid-transit facilities. Many of these plans were abandoned because it was thought that the automobile made them unnecessary. Reliance upon the automobile, however, has not provided an answer. Los Angeles, prototype of the all-automobile city, has proved that this approach to urban passenger movement, instead of solving the problem, has only made it more acute. Even with the construction of all the freeways now contemplated for Los Angeles, traffic conditions will be worse in 1980 than they are today unless a good mass-transportation system is provided.[2]

Metropolitan areas are continuing to grow. Between 1900 and 1950 metropolitan areas absorbed 73 per cent of the total population growth. In the decade 1940 to 1950, 81 per cent was absorbed by metropolitan areas, and from 1950 to 1955 the figure was 97 per cent.[3] This increase is continuing with a pronounced impetus because the rate of population

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[1] Washington Metropolitan Area Transportation Problems, Hearings before the Joint Committee on Washington Metropolitan Problems, Transportation Problems in Maryland, Virginia, and the Washington Metropolitan Area, 85th Congress, 2nd Session, May 22, 23, and June 10, 1958, U.S. Government Printing Office, 1958, p. 18.

[2] Transportation Plan for the National Capital Region, Hearings before the Joint Committee on Washington Metropolitan Problems on Report of the Washington Mass Transportation Survey, 86th Congress, 1st Session, November 9-14, 1959, U.S. Government Printing Office, 1960, p. 795.

[3] Philip M. Hauser, "The Challenge of Metropolitan Growth," Urban Land, Vol. 17, No. 11, December, 1958, p. 3.

increase itself has risen. The rate of automobile registration is increasing even faster than population.

The problem of passenger movement in metropolitan areas, if present trends continue, can only increase in magnitude. Neither the structure of the city itself nor the more widespread ownership of the automobile is responsible. It is the compulsory mass use of the automobile, brought about by the absence of a satisfactory alternative, that is the essence of the problem. A rapid-transit system, properly coordinated with other forms of passenger movement and planned so as to influence urban development in a more desirable manner, offers such an alternative.

Many metropolitan areas are conducting transportation studies. The plans based on these studies often include rapid transit as a necessary part of future development. In the preparation of this thesis, these plans and studies were utilized. The transportation plan for the National Capital Region was especially valuable because it was subjected to extensive Congressional hearings during which the elements of the plan were critically analyzed.

Existing rapid-transit lines and systems were also examined. Very little material has been published on any of these systems which is of specific benefit to the city planner. The New York system has had more published studies of its effects on land utilization, land value, and the movement of population than any other system. The fact that it is

the least typical of rapid-transit systems in the United States and was constructed before the automobile became a dominant factor limits the value of this information for metropolitan areas of today.

The subject of rapid transit is so broad that it has not been possible to cover all aspects. Further study is greatly needed, and it is hoped that this study will stimulate such research.

CHAPTER II

THE ROLE OF RAPID TRANSIT IN METROPOLITAN TRANSPORTATION

The total facilities available for the movement of people and goods within a metropolitan area form a general transportation system. In such an area rapid transit has a dual role to play: to serve as part of a unified transportation network, and to help in the attainment of urban development objectives. This chapter deals with the first of these roles.

There is no all-purpose carrier that, in itself, can constitute a transportation system. The complexity of passenger movement in the metropolitan area requires the use of many transportation media, each of which should be employed for the particular purposes that it is best able to serve. The automobile, bus, street car, and trackless trolley function most efficiently when coordinated with rapid transit into one comprehensive system.

Transportation systems which utilize only the automobile and mass-transit vehicles operating over the highways have not provided a solution to the problems of urban passenger movement. With the increase in metropolitan travel needs, the burden placed upon the highways has made it impossible for them to function efficiently. "This attempt to be urbanized and motorized at the same time has been less

than a complete success. The combination is destroying both the benefits of cities and the advantages of the private car."[1] By providing an alternative to the use of highway facilities, rapid transit can supplement the automobile and achieve a balance in the means of passenger transportation.

Complexity of movement due to separation of functions and division of labor may be considered a hallmark of the metropolitan area.[2] However, within this seemingly patternless motion, certain channels or corridors exist. Rapid transit best serves in these channels, and can be utilized to create additional channels where they are desirable. At the same time additional freeway requirements can be reduced, preventing large-scale destruction of residences, commercial and industrial structures, parks, and other valuable urban property.

Rapid-transit vehicles operate on rails over exclusive, grade-separated rights-of-way which may be in subway, elevated, at grade, or in open cuts. Although a single car may be employed, all cars must be of a type that can be joined into trains. Early rapid-transit systems such as those in New York, Philadelphia, and Boston, have an average speed of 20 miles per hour. This slow speed is essentially due to heavy,

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[1]Wilfred Owen, Cities in the Motor Age, (New York, 1959), p. 3.

[2]Leo F. Schnore, "The Timing of Metropolitan Decentralization," Journal of the American Institute of Planners, Vol. 25, No. 4, November, 1959, p. 205.

older equipment, and close station spacing. Modern systems have average speeds of over 45 miles per hour with station stops of one mile or more apart. The rated carrying capacity of one track in one direction is upwards of 40,000 passengers per hour.

This high capacity is utilized to its fullest potential when rapid transit becomes the framework to which other urban passenger carriers act as feeders. Joint scheduling, universal transfer privileges, a single fare, and ample parking facilities at suitable points bind the system into a unified whole. When there is competition between different types of carriers, a wasteful and poorly-coordinated system results.

Rapid transit and the automobile.--Rapid transit is an efficient user of urban land. Its right-of-way width for a two-track line is approximately 60 feet at stations and 33 feet between stations, while the right-of-way for the average freeway may be three times this amount. An eight-lane expressway requires approximately 36 acres per mile in urban areas, and a large traffic interchange may consume from 50 to 80 acres or even more. In Atlanta, it is estimated that even with bus service, if the highways continue to be the major channel of passenger movement, service to the downtown section will require 120 new radial lanes by 1970.[3] To serve the

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[3]Crosstown and Bypass Expressways, Expressway Policy Study No. 2, Metropolitan Planning Commission, Atlanta, Ga., 1959, p. 25.

increasing population of San Francisco by freeways alone would cost $5,000,000,000. The planned rapid-transit system will provide the same capacity at a cost of only $1,000,000,000.[4]

The cost per mile of expressways varies, but in dense urban areas it is extremely high. Not included in the direct cost is the loss of tax revenue to the city caused by the removal of property from the tax rolls, which in Cleveland is expected to amount to $120,000,000 annually when presently planned freeways are constructed.[5] When these costs are compared to the costs of rapid transit in terms of capacity, that is, the number of people that can be carried per hour, rapid transit will be seen to be much cheaper. On this basis $1.00 spent on rapid transit could do as much as from $4.50 to $35.00 spent on highways in congested areas.[6] Labor productivity in terms of passenger-miles per man-hour is many times greater for rapid transit than for any other form of public transportation. Fifteen

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[4]Paul W. Seibert, "Bay Area Preparing to Invest $1 Billion in Rapid Transit," Going Places, Vol. 1, No. 6, Nov-Dec, 1958, p. 4 (Reprinted from the Seattle Times, Sept. 18, 1958).

[5]Donald C. Hyde, Proceedings of the National Conference Co-ordinating Metropolitan Area Transportation, Chicago, 1957, p. 139.

[6]E. L. Tennyson, "Moving People in Urban Areas," Planning, Proceedings of the Annual National Conference of the American S ociety of Planning Officials, Chicago, 1953, p. 73.

persons can serve 22,000 riders per day on a rapid-transit system.[7]

Rapid transit also offers considerable savings in travel time. The benefit ratios (value of time saved compared to cost of facility) were calculated for rapid transit and for an expressway over the same distance. The ratio for rapid transit was 10, with only one-seventh of the capacity utilized, and 2 1/4 for the expressway at near safe capacity.[8] By conservative estimates, the modern, grade-separated transit system planned for the San Francisco area would save 20,000,000 man-hours per year in travel time, or expressed another way, would shrink the Bay Area to half its present size.[9]

In spite of their expense, additional freeways will be needed in urban areas. The passenger-carrying capacity of a freeway is increased three-fold or more when the center portion is utilized for a rapid-transit line. Incorporating such a line in the Congress Street Expressway in Chicago added only 10 per cent to the total cost (excluding tracks, rolling stock, etc.). Near the central business district this line enters a subway section which carries it through

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[7] Plan for South Philadelphia Subway Extension, Department of Public Property, City of Philadelphia, nd.

[8] Tennyson, op. cit., p. 77.

[9] Walter S. Douglas, National Conference Co-ordinating Metropolitan Area Transportation, op. cit., p. 28.

the congested part of the city. Since few radial expressways penetrate the central business district, it is advisable for rapid transit lines to leave expressways and continue through the downtown area by subway.

Whether rapid transit occupies the center mall of a freeway or utilizes an independent right-of-way, it should be coordinated with the automobile by provision of parking space at outlying stations. Wherever possible, these lots should be located at points where rapid-transit lines and highways intersect. The value of parking facilities is illustrated by the experience of Cleveland. A survey of rapid-transit patrons made before parking facilities were provided revealed that 20 per cent formerly drove downtown. After parking lots were built another survey was made. This time it was found that those who formerly drove to the central business district constituted 71 per cent of the parking lot users.[10]

The large number of parking spaces required at the outlying stations may make parking structures desirable. To park 2500 vehicles requires about 17 acres, and some users will have to walk a quarter of a mile from the far corners of the lot. Chicago plans to construct a number of "Park-and-Ride" garages at major rapid-transit-expressway locations where land is difficult to obtain. Some of the structures will be over the rapid-transit right-of-way,

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[10]Hyde, op. cit., pp. 134-5.

providing the additional advantages of shorter walking distance and protection from the weather for both automobiles and drivers.

Also important in the coordination of the automobile and rapid transit are the so-called "kissing loops." These are loops inside rapid-transit stations which make it possible for passengers to be picked up or discharged from automobiles driven by others. This arrangement reduces demand for both feeder bus service and parking space.

Parking facilities on the outskirts reduce the need for downtown parking just as rapid-transit lines reduce the need for arterial expressway lanes. A downtown worker requires about 120 square feet of floor space for himself, while his automobile takes 200 square feet.[11] The downtown area, basically designed for the pedestrian, loses its compactness and hence part of its economic advantage when it is broken up with extensive parking lots and parking structures.

Rapid transit also provides standby service for the motorist at times when for some reason the automobile cannot be used. When weather conditions make roads hazardous for driving, the increase in rapid transit use is readily observed.[12, 13] The economic losses resulting from severe

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[11] Owen, op. cit., p. 104.

[12] Washington Metropolitan Area Transportation Problems, op. cit., p. 418.

[13] Chicago Daily Tribune, February 17, 1958.

snowstorms, etc. can be lessened with a good rapid-transit system.

Rapid transit and local passenger movement.--Other than automobile travel, passenger movement in the more densely developed urban area consists of local transit and pedestrians. Local transit vehicles include buses, trackless trolleys, and street cars. When a rapid-transit system exists, local transit serves two purposes: to feed to and distribute from the rapid-transit lines, and to carry short-haul passengers (5 miles or less) in areas between the rapid-transit radials. The greater the convenience of transfer from local transit to rapid transit, the more attractive and efficient the operation becomes. In peak hours when service is frequent for both rapid transit and feeders, there will be little waiting time while transferring. However, in the off-peak hours coordinated schedules are very important, as infrequent service and lengthy waiting times may discourage use of the facilities.

Until 1947, Chicago rapid-transit facilities were operated by one private company and the surface lines by another. There was competition and lack of coordination between the facilities. The Chicago Transit Authority, a quasi-public body created by the Illinois Legislature, purchased all the facilities and integrated them into one system. Two-thousand six-hundred buses and six hundred electric trolley coaches are now coordinated with rapid-

transit lines.[14]

The Shaker Heights Rapid Transit in Cleveland, probably the most widely-known rapid-transit line in the United States, acts as its own feeder system. This ten-mile line connects the Shaker Heights suburb with downtown Cleveland. Between Union Terminal and Shaker Square the vehicles operate on an exclusive, grade-separated right-of-way. At Shaker Square the line divides into two branch lines which are located in the center malls of boulevards with grade crossings. The vehicles load at street level, picking up and discharging passengers at street corners.[15]

In most instances rapid transit is considered accessible to pedestrians within a radius of a quarter of a mile of a station. All rapid-transit stations will receive a certain amount of pedestrian patronage. In the central business district, however, the majority of rapid-transit riders will be pedestrians. There are several possible arrangements for collection and distribution of these patrons.

If a number of radial lines pass through the central business district, stations can be located within a reasonable walking distance of any part of it. This method,

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[14]Rapid Transit Systems in Six Metropolitan Areas, Staff Report Prepared for the Joint Committee on Washington Metropolitan Problems, C ongress of the United States, U.S. Government Printing Office, November, 1959, p. 9.

[15]Ibid., pp. 33, 4.

however, concentrates all movement through the center, including through traffic. Many routes going through one or two stations also has the disadvantage of causing large accumulations of passengers waiting for their particular trains.

If a belt line is incorporated into the system, the disadvantages of the all-radial layout can be avoided by the diversion of through traffic around the downtown section. The belt line touches the central business district at some point, from which further distribution can be accomplished by means of moving sidewalks or similar devices. Such a system has been proposed and a plan worked out for Cincinnati, Ohio.[16]

Where a belt line is not feasible because of topography or other local conditions, a trunk line can be utilized to pass the central business district at a peripheral point. Either belt line or trunk line could distribute traffic by means of a subway loop. A loop of this type has been planned in Cleveland to enable the existing trunk line[17] which touches the central business district at its outer edge to serve the entire downtown area.[18]

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[16] Analysis of Underground and Overhead Passenger Conveyor System for Downtown Cincinnati, City of Cincinnati, Department of Public Works, Division of Engineering, Cincinnati, 1955.

[17] This refers to the Cleveland Transit System line rather than the Shaker Heights line.

[18] Rapid Transit Systems in Six Metropolitan Areas, op. cit., p. 31.

The coordination of rapid transit, local transit, and pedestrian movement is of especial benefit to non-drivers. More than half the residents of metropolitan Philadelphia do not drive.[19] A study made of automobile ownership and usage by the Division of Research, Bureau of Public Roads, showed that only 57 per cent of family units owned motor vehicles in cities of 100,000 and over, and that only 53 per cent of all persons 14 years or older were licensed to drive. Of the total population over 14 years in incorporated areas, only 72.8 per cent of the males and 34.3 per cent of the females were licensed drivers.[20] While this study covered only six states, it reveals that the automobile is not as universally employable as congested streets in metropolitan areas might indicate.

Rapid transit and commuter transportation systems.--The greatest proportion of inter-urban transit is made up of commuter travel. This daily travel originates or terminates within the 10 to 40-mile tributary zone, and employs suburban buses and commuter railroads. The suburban buses should have terminal points at outlying rapid-transit stations. A number of such terminals have been proposed in Chicago.

It is also desirable for electrified suburban trains to be switched from railroad rights-of-way to the rapid-

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[19] Plan for South Philadelphia Subway Extension, op. cit.

[20] Motor Vehicle Use Studies in Six States, Public Roads, Vol. 28, No. 5, December, 1954, pp. 99-108.

transit system at convenient points in the city, thus distributing this traffic as well.[21] Where this is not feasible, accommodations for quick, convenient transfer from commuter trains to rapid transit would accomplish the same purpose. Downtown stub-end terminals for commuter railroads are inefficient. "A through station track can handle at least four times as many trains per hour as a stub-end terminal track."[22] The Old Colony commuter line presently terminates in downtown Boston. Passengers transferring to the Boston subway must leave the terminal and enter the subway through regular street entrances. A plan has been prepared to integrate this line with the existing subway system, providing convenient through service.[23]

Wherever possible, commuter lines themselves should be converted to rapid-transit operation. Many existing rapid-transit systems have incorporated such lines. A recent example (July 1959) is the 11.5-mile Highland Park line, formerly a branch of the Boston and Albany Railroad. Under suburban operation, only 1,100 persons used the four daily round trips. After the line was converted to rapid transit, weekday operation increased to 23,000 persons within two

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[21] Local Planning Administration, 2nd Ed., International City Managers Association, (Chicago, 1948) p. 138.

[22] Stanley Berge, "New Horizons for Commuter Service," quoted in Going Places, Vol. 1, No. 4, July-August, 1958, p. 15.

[23] Congressional Record, 86th Congress, 2nd Session, Vol. 106, No. 56, March 28, 1960.

months. Nineteen of every 20 riders formerly drove downtown.[24] Buses and automobiles serve as a local transportation system between such suburban rapid-transit lines and furnish means of access to them.

Rapid transit provides a dependable, safe, all-weather means of urban passenger circulation. Primarily a mover of people rather than vehicles, it is also an efficient user of urban land. Coordinated with all other forms of metropolitan passenger movement, rapid transit will help expedite the movement of large numbers of people from areas of low density to areas of high density. The flexibility of the automobile and the high capacity of rapid transit, complementing each other, can achieve a balance in the metropolitan transportation system.

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[24]Transportation Plan for the National Capital Region, op. cit., p. 950.

CHAPTER III

RAPID TRANSIT AS A TOOL OF CITY PLANNING

Of the many forces that influence the pattern of urban development, the transportation system is probably the most powerful. This aspect of transportation has seldom been used to creatively guide growth according to an over-all plan. Instead, transit routes and station sites have generally been selected on the basis of securing the greatest number of passengers. With passenger movement as its only goal, this approach has usually resulted in haphazard, inefficient development. This chapter is concerned with the creative use of rapid transit as a city planning tool for the attainment of urban development objectives.

By channelizing passenger movement, rapid transit also channelizes development. This effect is useful in minimizing urban sprawl and producing more compact development, which makes the provision of municipal services more efficient and helps preserve open spaces in the metropolitan area. The location and number of rapid-transit lines, the timing of construction, the kind of system chosen (elevated, subway, etc.), the capacity provided, and the location and spacing of stations produce specific effects on community development.

Although the whole community profits from rapid transit, the greatest benefit accrues to property which is made more accessible by the transit facilities. When there is an over-all, long-range plan for metropolitan development, the improved accessibility provided by rapid transit supplies an added impetus for private investment to take place in harmony with community objectives.

Community Goals

"Since transportation is a means to other ends, we need to have some picture of those ends before we can plan the sort of transportation system that will help in achieving them."[1] Certainly maintaining and enhancing the vigor of the central business district is one of the primary goals of the community. However, the really critical objective is the formulation of developmental goals for the entire metropolis. The difficulty of trying to work out a long-range transportation plan without a plan for area development became apparent during the Miami metropolitan area transportation study. This study recommended that for adequate transportation planning, a purpose, pattern, and direction for land development be first decided upon.[2] In the absence of a general area development plan, the need for guidance in rapid-transit

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[1] Owen, op. cit., p. 141.

[2] A Study of Traffic and Transportation in Metropolitan Dade County, 1958, Department of Traffic and Transportation, Dade County, Fla., Miami, 1958, p. 9.

development may stimulate over-all planning. The first governmentally-supported regional plan ever attempted for the San Francisco Bay Area was prepared as an integral part of a rapid-transit study. This comprehensive plan was considered so valuable to the nine counties involved, that each contributed financially to the study. The transportation facilities were conceived as tools by which the form of the metropolitan area could be deliberately shaped over the long-range future.[3]

Predicting future needs involves a series of assumptions. Whatever the assumptions utilized, their selection is in effect a policy question. In a multi-jurisdictional metropolitan area it is difficult to develop an over-all policy. Since rapid transit affects the entire community, and since it is the citizens who will, in the long run, pay for the facilities, the public at large should have a voice in the process of policy formulation. All possible avenues of reaching and involving the public should be used while the plan is in preparation to insure community participation, ideas, education and interest.

The Washington, D. C. transportation plan was prepared by consultants and specialists. When the plan was subjected to Congressional hearings, sharp differences were disclosed between the ideas of the consultants and the views of various

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[3]M. H. West, "San Francisco Bay Area Transportation, 1960," Traffic Engineering, Vol. 30, No. 4, January, 1960, pp.14, 19.

citizens groups as to the kind of city Washington should become. The citizens groups felt that Washington, as the nation's capital, should develop as a monumental city in a park-like atmosphere, without extensive industrial uses, and with primary emphasis on rapid transit, rather than more highways.

It is generally assumed that the average citizen thinks that the solution to the problem of transportation and congestion in the metropolitan area is more highways and roads. After an educational program was conducted in San Francisco, the voters rejected seven out of ten proposed freeways. Surveys revealed that 90 per cent of respondents believed traffic congestion would increase without rapid transit and 79 per cent favored the rapid-transit plan.[4]

The financing of rapid transit will require some public funds or the pledging of public credit. There is always continuous competition for funds for many community needs such as slum clearance, provision of water and sewerage, schools and school programs, recreation programs, etc. Rapid transit must share available funds with these other needs. Therefore the number and importance of other needs will in part determine what amounts are to be spent for rapid transit.

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[4]Transportation Plan for the National Capital Region, op. cit., pp. 147-8.

Studies

> Each functional part of anything derives its value and efficiency from its relationships to the other functional parts; with a consequence that some degree of planning or designing the whole is necessary for an acceptable determination of the location of any part.[5]

Since a rapid-transit system has such far-reaching effects upon a metropolitan area, it cannot be studied in isolation from other aspects of the city's growth and development. Rapid-transit studies are most effective when made as a part of the transportation study, which, in turn, should be a part of the general development plan. Studies should not only take inventory, that is, find out what exists, but should also seek the causes of existing conditions. Projection or extrapolation of statistical data alone cannot give a reliable picture of the future. At best, such information helps to bring into focus the issues upon which policy decisions must be made. Since future population, growth in business activity, and shifts in land-use requirements and locations, are variables, a number of forecasts based on different assumptions for each variable should be prepared. With knowledge of the implications and consequences of each possibility, policy-makers are better able to decide upon the transportation system that will best influence the course of metropolitan development.

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[5]Alfred Bettman, City and Regional Planning Papers, (Cambridge, Mass., 1946) p. 93.

In a metropolitan area contemplating rapid transit, there must first be an organization to conduct the preliminary surveys and studies, prepare the plans, and make recommendations as to the ultimate organization that will build, operate, and finance the system. The agency that conducts these studies must be empowered to plan for the entire metropolitan region, and must take a comprehensive view of passenger movement.

The most logical organization to take responsibility for this work is one that is already planning for the metropolitan area. This organization will probably have accumulated certain basic data and may have already prepared a general development plan. In planning for the rapid-transit system such an agency would be in an advantageous position to coordinate rapid transit with area development.

In a number of metropolitan areas, organizations have been created specifically to perform the required rapid-transit system studies. Their work should include or be based upon a plan for the development of the region to be served by the rapid-transit system. In the San Francisco Bay Area, a Commission established by the State Legislature served as the preliminary organization. In the New York-New Jersey area, the legislatures of the two states created the bi-state Metropolitan Rapid Transit Commission. In the Pittsburgh metropolitan area, the program was entrusted to a group created by the Board of Commissioners of Allegheny County.

Whatever the agency selected, it usually carries out its work in one of the following ways:

1. Direct employment of all personnel involved in the project.

2. Employment of a small staff supplemented by a panel of experts to handle specialized phases of the work.

3. Delegation of the entire project to a consultant firm.

When the studies are completed, the results are usually presented in the form of a report containing plans for the development of the rapid-transit system, recommended organizational and financial structure, and suggested enabling legislation.

An important part of the work of the preliminary organization is the dissemination of information and education of the general public. Where enabling legislation is necessary, public support will facilitate its passage. The enabling legislation required to set up the Allegheny County Transit Authority was never enacted, partly due to lack of public support. A favorable attitude on the part of the public can hasten the establishment of the organization that will carry out the program of rapid-transit development.

Most transportation studies have four major parts: design engineering, fiscal and organizational studies, general development plan, and traffic analyses. Design engineering studies show exact location of rights-of-way,

grades, structures, station sites, and appurtenant facilities. Fiscal and organizational studies determine costs, phasing of expenditures, budgetary limitations, and the organizational and administrative structure.[6] The general area development plan and traffic analyses are discussed below.

General area development plan.--The general development plan is based upon studies of economy, population, and existing land use, which provide information for estimates of needs 20 to 25 years in advance. The over-all plan for the development of a metropolitan region should be prepared in advance of more detailed rapid-transit studies. Land required for future residential, industrial, commercial, and public uses is allocated in the development plan and its approximate location designated. Present and future utility lines and transportation facilities are also indicated. Several alternative rapid-transit networks should be designed and their effects on the general development plan weighed. This process will enable the planner to arrive at a plan which comes closest to achieving urban development objectives.

Traffic analyses.--Traffic studies are made for the purpose of determining existing traffic conditions and estimating future movement between various sections of the city. There are many types of traffic studies, and more elaborate methods

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[6]Chapter IV is concerned with types of organizational and financial arrangements.

are constantly being developed. Wilbur Smith and Associates, traffic consultants to the mass transportation study of the Washington metropolitan area, state that there are no standard methods for predicting the patterns of future travel. Although several new procedures were used in the Washington study, they were experimental and, in many respects, constituted research into methods for the projection of future urban travel.[7]

All projections of passenger movement are based on assumptions, and are ultimately the product of judgment. The making of sound judgments under conditions of uncertainty cannot be reduced to a series of formulae, nor can the statistical approach be substituted for creative city planning.

> By diligent study of the positions of commerce, business, industry, schools, residential and recreational areas in relation to geography and the total street pattern of the entire metropolitan region it is actually possible for the sensitive observer to identify the proper corresponding networks of rapid transit and surface transit route locations that will inevitably be necessary for provision of the comprehensive system of adequate transit. It is submitted that this process can be done with such a high degree of accuracy as to obviate the tedious, time-consuming and costly interpretation of such a system by the traditional engineering study projects employed now and in the past.[8]

Effects of Rapid Transit on Land Use and Land Value

The influence of rapid transit stems from its ability to increase the accessibility of those areas which it serves.

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[7]Washington Metropolitan Area Transportation Problems, op. cit., p. 402.

[8]Ibid., p. 934.

It is this increased accessibility which makes a given piece of property or section of the city more desirable. Such added accessibility is a direct, marketable benefit.[9]

Shifts in location of land uses are accelerated by rapid transit. This brings about a transfer of values from areas not served by rapid transit, the degree of increase varying with different land uses, proximity to stations, and other factors.[10] Of equal importance is the stimulation which results in new construction and additional investment, leading to the creation of new values. Since rapid transit promotes shifts in the pattern of land use, a system designed to serve existing needs only will be of limited long-range benefit to the metropolitan area. The maximum utility of rapid transit is realized when its potential for guiding development is considered in the planning of the system and in the general development plan as a whole.

A city represents a tremendous investment in fixed physical improvements, and a lag in the over-all adjustment in land use and land value to the presence of new facilities is to be expected. Where conditions are more or less fluid or where exceptionally profitable investment is offered, changes will occur more rapidly. Different types of land use respond in different ways to the presence of rapid-

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[9]Report of the Street Railway Commission of the Rapid Transit Commission to Honorable John C. Lodge, Mayor, Detroit, 1929.

[10]Report of the Committee on Rapid Transit, No. 106, Proceedings of the American Electric Railroad Association, New York, 1928, p. 275.

transit facilities. Some of these specific effects are discussed below.

Residence.--Traditionally the growth of a city has been the growth of its population. Residential development extended outward along public transportation routes and was followed by shopping centers, schools, industries, etc. "In developing residential land where transportation facilities were absent, the subdivider was ordinarily obliged to subsidize for a time a bus line or trolley extension."[11]

Early Los Angeles once had a very extensive street car and inter-urban system. Most of the lines were built before sufficient patronage was available to make them self-liquidating.[12] Henry Huntingdon, a real estate developer and large land-owner in southern California, constructed much of the system. By serving his residential developments with street railways he assured the sale of his subdivisions while at the same time fostering development of outlying land.[13] In Cleveland, Otis P. and Mantis J. Van Sweringen developed the Shaker Heights subdivision by running a ten-mile transit line from the downtown district to this area.[14]

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[11]Richard T. Ely and Edward W. Morehouse, Elements of Land Economics, (New York, 1932) p. 297.

[12]Street Traffic Management for Los Angeles, a Report of the Los Angeles Traffic Survey Committee, Los Angeles, 1948, p. 27.

[13]Arthur L. Grey, Jr., "Los Angeles: Urban Prototype," Land Economics, Vol. 35, No. 3, August, 1959, p. 233.

[14]Washington Metropolitan Area Transportation Problems, op. cit., p. 212.

Although not part of an over-all development plan, such transit lines made outlying, cheaper land accessible. After these lines were constructed, subdivision followed subdivision in a fairly compact manner.

Land converted from open uses such as farming or forest into residential use multiplies many times in value. The work involved in surveying, grading, dividing into streets and lots, installing water and other utilities, financing, and selling requires this increase in value to make development profitable. Outlying territory tapped by a rapid-transit line running to the center of the city will be stimulated into such conversion. To this extent, rapid-transit facilities hasten the rise in land values. No other increase is as great during any period of development as this initial conversion of the land.

Before the advent of widespread automobile ownership, rapid-transit lines were designed to serve the pedestrian. The influence of rapid transit was considered to be limited to a quarter-mile radius of the line or feeders. Each mile of new line was estimated to create the possibility of housing an additional 25,000 families in apartments or 4,500 in detached dwellings, with ready access to the city.[15] With the automobile serving as a feeder, the influence would be spread over a much wider radius, perhaps as much

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[15] Regional Survey of New York and Its Environs, (New York, 1931) Vol. 2, p. 126.

as four miles.[16]

The completion of the first element of a rapid-transit system; e.g., a line from the central business district to an outlying residential section, will place this section in a comparatively favorable position. As other lines are constructed and the system develops, the advantages to any one section diminish. The construction of an extensive rapid-transit network cannot be accomplished in a short time; however, the early reservation of rights-of-way will tend to stimulate development in anticipation of the line.

The desirability of particular residential locations depends on many factors, of which accessibility is one of the most important. High-grade residential areas, therefore, tend to develop along the fastest existing transportation lines.[17] Cleveland's Shaker Heights and Pittsburgh's South Hills, both served by rapid transit, are among the finest residential areas in their respective cities.

The effect of rapid transit on land utilization is most pronounced where the character of development is least fixed. A large cemetery, for example, is a land use that is extremely difficult to change. Adjacent land is generally

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[16]Report to the Legislature of the State of California, San Francisco Bay Area Rapid Transit Commission, 1957, p. 114.

[17]Homer Hoyt, Structure and Growth of Residential Neighborhoods in American Cities, (U. S. Government Printing Office, 1939) p. 117.

undesirable for residential purposes, and would not be likely to undergo residential development because of the installation of a rapid-transit line.[18] In an area poorly drained and unfit for habitation, rapid transit may hasten the installation of drainage works so that residential construction is possible. If the cost of drainage is greater than that of developing land beyond the swamp, the land further out will probably be developed first. However, the shifts in land value that will follow the rapid-transit line will make the near-by land so valuable that it will eventually be developed.

Rapid transit and urban redevelopment should be coordinated. Where premature subdivision, clouded titles, tax delinquencies, etc. have made large, suitably-located areas unmarketable, a rapid-transit line will provide an added stimulus to urban redevelopment projects or other means of overcoming these barriers. The redevelopment of blighted areas can be expedited by extension of rapid-transit service. The planned conversion of the Rockaway Commuter line of the Long Island Railroad to rapid transit accelerated the clearance of low-density, sub-standard housing in Rockaway. The project included high-rise apartments and commercial facilities, centered about a rapid-transit station.[19]

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[18]Edwin H. Spengler, Land Values in New York in Relation to Transit Facilities, (New York, 1930) p. 118.

[19]Seaside Rockaway, Slum Clearance Plan under Title I of the Housing Act of 1949, New York, 1954, pp. 7, 33.

An elevated line in a residential area will tend to stimulate development; however, the land immediately fronting on the elevated line may fall in value because of the noise and deprivation of light and air. These adverse effects were recognized in Boston, where property owners were compensated for damages resulting from the construction of an elevated line.[20] A lease closed in New York specified that the tenant would pay a substantially increased rental if, during the life of the lease, the elevated rapid-transit structure fronting on the property were removed.[21] Property not immediately adjacent to an elevated structure, however, receives the benefit without the disadvantage. If buffer strips are utilized to separate an elevated line from residential uses, the undesirable effects can be minimized.

As a tool for guiding the location of residential development, rapid transit is best employed when it precedes population. Where scattered development has already occurred and a rapid-transit line is constructed to serve an area, more intensive uses will result, and the remaining vacant land will be developed.

Commerce.--The central business district is the major commercial, financial, governmental, cultural, and professional center of the metropolitan area. As the city grows this

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[20]Report on Improved Transportation Facilities in the Boston Metropolitan District, Division of Metropolitan Planning, Commonwealth of Massachusetts, Boston, 1926, p. 41.

[21]Spengler, op. cit., p. 55.

center must serve more people located throughout a larger area. A rapid-transit network can unify the metropolitan area, tying the central business district to all other parts. The accessibility provided by rapid transit can bring large numbers of people into the downtown area without adding to vehicular congestion. This increased accessibility makes it profitable to tear down existing structures in order to make way for new buildings of greater height, favoring more intense use of land. The process of removal of marginal uses which no longer are an essential part of central business district activity is thereby hastened.

When streets have reached their capacity for moving people into the downtown area, a brake is placed upon further construction in the central business district. Property in the downtown areas of some cities is actually declining in value. In Baltimore, for example, a major department store won a $125,000 tax reduction in 1959 on the grounds of deterioration of the downtown retail area caused by traffic congestion and lack of adequate transit service.[22] Downtown Detroit real estate values have dropped a billion dollars in fifteen years, primarily because of delays and inconvenience of moving in and out of the city.[23] On the other hand,

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[22]Transportation Plan for the National Capital Region, op. cit., p. 980.

[23]E. E. Kearns, "Coordinated Transportation for Large Metropolitan Communities," Paper Presented at the American Institute of Electrical Engineers Winter General Meeting, New York, 1952.

central business district land values in Toronto are gaining. From 1950 to 1958, during four years of construction and four years of operation of the rapid-transit system, the central business district gained 85 per cent in value. Average increase in value for all property served by the line was 37 per cent, while for the rest of the city the increase was only 20 per cent.[24]

Land values are highest in the immediate vicinity of a rapid-transit station, and taper off as the distance from the station increases. The influence of a rapid-transit station on land value where pedestrian movement dominates is assumed to be within a quarter-mile radius of the station. In the central business district, therefore, location of stations no more than half a mile apart will tend to equalize values.

The central business district is an area of high density. Concentrated land use, however, does not necessarily mean that there must be congestion. It is a combination of high density, ill-balanced transportation facilities, and improper relationships among uses that produces congestion. An example of an extremely high-density area relatively free from congestion is the Wall Street financial district of New York. This section carries on a group of closely-

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[24]Report to the Council of the Municipality of Metropolitan Toronto on East-West Rapid-Transit Proposals, Appendix "E", Building Development and Increased Assessments in Areas Served by Yonge Street Subway, Toronto Transit Commission, Toronto, nd, p. 2.

related business functions, has no through traffic, and is served by rapid-transit lines of high capacity.[25] Twenty-two subway stations serve the tremendous numbers of people who work there.

Rapid transit encourages development geared to the pedestrian. Pedestrian malls with fountains, grass, trees, benches, and other amenities, installed in conjunction with rapid-transit facilities and restriction of vehicular traffic, could make the central business district more attractive.

Within a metropolitan area, in addition to the primary business district, local centers exist which attract most of the business activity of their respective areas. If streams of population are drawn into these centers by rapid transit, the value is enhanced at the expense of areas which are tapped by the lines.

Transfer points where a rapid-transit line meets a feeder route provide advantageous locations for local shopping centers. If two rapid-transit lines converge or cross each other, there is a still greater potential for the growth of a business area. Where a station is located at an intersection of the main street of a given locality, the existing commercial area around the station will be further stimulated. If a station is located on a minor street, a commercial center will probably develop and the nearby main street show a gradual decline.

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[25] Regional Survey of New York, op. cit., Vol. 1, p. 144.

Where two large urban concentrations overlap, a rapid-transit line connecting their central business districts would tend to increase the dominance of the more active center. The downtown district of Camden, New Jersey was experiencing a decrease of business activity, and a rapid-transit line extending between the center of Philadelphia and the center of Camden failed to stop this decline. A plan has been prepared for the extension of this line into the outlying Camden metropolitan area. Three existing railroad lines will be unified and electrified, outlying parking lots furnished, and grade separations built.[26] Since Philadelphia's central business district already serves both metropolitan areas, these additional rapid-transit lines will probably reinforce the trend.

Industry.--The presence of rapid transit, providing accessibility for large numbers of workers, can have great influence in choice of location for those industries to which such accessibility is of prime importance. In Chicago, 31 points served by rapid transit form the centers of employment.[27] An industrial district so served may experience additional growth.

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[26]Plan for a High Speed Mass Transit Service between Philadelphia and Camden and South Jersey Suburbs, City of Philadelphia Urban Traffic and Transportation Board, Philadelphia, 1959.

[27]H. M. Brinckerhoff, "The Effects of Transportation on Distribution of Population in Large Cities," Proceedings of the 13th National Conference on City Planning, Pittsburgh, 1921, p. 52.

Industrial districts would be enhanced in value by the extension of rapid transit. A site suitable for industry would become more desirable for development. Where industrial uses are located in obsolete structures or are conducting marginal operations, especially in the central business district, a rapid-transit facility will act to accelerate clearance and rebuilding.

Development of a Rapid-Transit System

Each metropolitan area has an individual character. Its primary function may be industry, financial and governmental activity, tourist trade, or any of the other major urban functions. There is no one type of rapid-transit system that fits all these conditions. Population has been considered the main criterion for determining whether rapid transit is needed; figures ranging from 60,000[28] to 750,000[29] have been estimated as the point at which rapid transit becomes feasible. The need for a rapid-transit system, however, should be determined not only by population, but also by the street pattern, the location and concentration of various land uses, and the amount of congestion on existing traffic arteries.

A rapid-transit system is a stable structural element of the city, comparable in many respects to streets or water

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[28]Tennyson, op. cit., p. 77.

[29]Lawrence Lessing, "Sick Transit: The City's No. 1 Problem," Architectural Forum, Vol. 110, No. 1, January, 1959, p. 120.

mains. Like the skeleton or framework of a building, around which alterations take place, rapid-transit lines remain while neighborhoods change in character. Like the utility distribution system of a city, which is never really complete, a rapid-transit system should grow as the city grows. The earlier a system is built the sooner the riding habit will develop. With the growth of the riding habit, many street widenings and new road projects may become unnecessary, saving the community the expense of this construction.

Rights-of-way.--There is no single ideal right-of-way for rapid-transit lines. Existing railroad lines, center malls in future limited-access highways, abandoned street car lines that formerly operated on exclusive rights-of-way, or newly-acquired rights-of-way may be used. Rochester, New York, Newark, New Jersey, and Cincinnati, Ohio have rapid-transit lines in old canal beds.[30]

In the central business district a subway is usually necessary. Subway rights-of-way are relatively easy to obtain and do not require destruction of buildings; however, construction costs are high. Under past methods of construction, it sometimes took several years to build subway portions, creating an undesirable situation downtown. With new construction techniques, however, the period of downtown

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[30]W. T. Rossell and David Q. Gual, "Rapid Transit's Value to a City," Traffic Quarterly, Vol. 10, No. 1, January, 1956, p. 110.

disruption is only four to six weeks.[31] At the same time the subway is built, an opportunity is presented to rehabilitate the underground utilities in the downtown area, which usually are the oldest in the city and often in need of repair.

Abandoned railroad rights-of-way are often utilized for rapid transit. Frequently such rights-of-way serve industrial uses and then pass through outlying residential districts. If the right-of-way is used for rapid-transit operation, workers who live in the residential areas would have convenient transportation to the industries served by the same line. This convenience would make the residential areas especially desirable for these workers. If the line also served the central business district and downtown residential areas, "reverse commuting" could take place. Grade separations would have to be built where the right-of-way crosses highways at grade.

When a median strip in a freeway is to be utilized for rapid transit, the plans for these facilities should be completed before construction of the freeway is begun. If this is not done, the resulting lack of coordination in construction will make the costs much higher. Whenever bridges, underwater tubes, or tunnels are built for automotive traffic, consideration should be given to providing right-of-way for

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[31] Transportation Plan for the National Capital Region, op. cit., p. 949.

future rapid transit. In these cases, great savings can be realized through joint planning.

Rapid-transit construction, however, should not be inflexibly tied to road construction. In some cases, a transit line may be needed in an area in which additional highway facilities are not desirable. In other cases a freeway may be built in an area in which rapid transit is not desirable. The incorporation of rapid transit in a freeway designed as a bypass may encourage dense development along the route, and the purpose of the bypass may be lost. In sections where dense development has already taken place and the destruction of existing structures would make freeway construction very expensive, subway or elevated lines may be the most economic solution. If it is desirable to incorporate rapid transit into a freeway already built, an elevated structure over the center portion of the freeway could be utilized. The automobile lanes on both sides would act as buffers, protecting abutting property from the disadvantages of the elevated.

A phased method of development of rapid transit in freeways has been advocated in which there would be initially three peak-hour reversible lanes for automobiles in the center mall. In the next stage of development, these automobile lanes would be converted to two express bus lanes. Eventually rapid transit would be installed in the center mall. If traffic volume warranted it, stage two could be

omitted.[32] The existence of a rapid-transit right-of-way would influence development along the freeway and hasten the need for construction of the line. In the long run it would probably be cheaper to install rapid-transit at the outset and save the expense of the two preliminary stages.

Where the right-of-way for a transit line is provided in an open cut, the air rights above the open cut may become valuable, especially near the downtown area. The building boom in Toronto resulting from their rapid-transit line has made downtown locations so desirable that certain sections of the open cut are being considered as locations for the erection of buildings.[33]

The development of a rapid-transit system will take place over a relatively long period of time, and delays in reserving rights-of-way may make them difficult and costly to obtain. The existing Official Map Act should therefore be broadened to include rapid-transit rights-of-way, or a separate Rapid Transit Official Map Act enacted. Land subdivision regulations should be revised so that future rapid-transit rights-of-way will be reserved where needed. These may be set aside through easement, dedication, or may be purchased by the community. In urban redevelopment projects

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[32] Transportation Plan, National Capital Region, National Capital Planning Commission and National Capital Regional Planning Council, Washington, D. C., 1959, p. 72.

[33] Rapid Transit in Six Metropolitan Areas, op. cit., p. 37.

it may be possible to reserve rights-of-way in convenient places for future transit lines.

Lines and routes.--The art of developing a rapid-transit system is in arranging the lines in such a way as to serve present needs, prepare for future needs, and at the same time influence metropolitan area development according to an over-all plan. The fully-developed network may have main trunk lines, belt lines, loops, branch lines, and feeder lines. Initial trunk lines should be considered for all traffic corridors on which rush-hour travel exceeds 15,000 persons per hour on a single route or group of routes which could be combined.

The higher the capacity of a rapid-transit line the denser the development that is made possible. If the object of transit planning is to avoid extremely high densities, then extremely high-capacity lines should not be built. It would then be better to have a network of lower-capacity lines so as to distribute development more evenly. When an area builds up to the point where a two-track line is becoming overcrowded, a parallel line installed a mile or more away will have a better effect on distribution of population than increased capacity on the old line. In this manner the two additional tracks provide service to another section of the city.

A route with two express and two local tracks furnishes very high capacity along with relatively higher speed for the

express. Older rapid-transit systems with close station-spacing have frequently employed this arrangement. Two-track lines with stations spaced at least one mile apart enable transit vehicles to operate at high speeds, and avoid the added expense of express-track construction. The modern Cleveland system was built without express tracks. If even greater speed is desired, the "A and B skip-stop" method may be instituted, in which alternate trains stop at alternate stations.

Topographic conditions and political boundaries may have the effect of encouraging a one-sided development of facilities.

> The wide barrier of the Hudson River and the boundaries between the states of New York and New Jersey, passing down the center of that river, prevented a complete radial or circumferential development of any type of rapid-transit lines in New York.[34]

A number of plans for overcoming this undesirable condition have been prepared.[35] When remedial measures are applied after the basic system has been built, the costs are much greater than if an over-all plan had been followed from the beginning.

The greater the number of activities served by rapid transit in a metropolitan area, the more effective the system becomes. Service to stadiums, parks, auditoriums,

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[34] Regional Survey of New York, op. cit., Vol. 4, p. 19.

[35] Rapid Transit for the New York-New Jersey Metropolitan Area, Report of the Metropolitan Rapid Transit Commission, New York, January, 1958.

commercial, educational, medical, and cultural centers, would encourage off-peak travel. The well-known New York rapid-transit connections to the beaches have made these areas available to millions of people. In the plan for the South Philadelphia Subway Extension, service will be furnished to the Philadelphia Municipal Stadium. The 3,000 parking spaces at the stadium will also be used as park-and-ride facilities for the subway.[36]

Outer circumferential or peripheral rapid-transit lines connecting the more important sub-centers or satellite communities can provide decentralized, accessible sites for industrial districts. One of the fundamental proposals of the San Francisco regional plan is the use of rapid transit to focus accessibility at outlying points, inducing business firms to locate there, thus creating a number of high-density employment centers.[37]

In a suburban area, the evolution of a rapid-transit line would probably take the following course. Initially, most of the patrons would use "park-and-ride" and "kissing loop" facilities. As the area developed, feeder mass-transit service would be initiated. More intensive development close to the station would make it possible for a large number of people to walk to the rapid-transit line. Eventually a feeder line might be replaced by a rapid-transit

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[36]Plan for South Philadelphia Subway Extension, op. cit.

[37]West, op. cit., p. 14.

branch line, if the development that such a line would engender is desirable for this particular section.

In the initial planning of a system, detailed routings of feeder operations need not be made. These routes are easily modified and can best be established after the system has been working long enough for the most feasible routes to be selected. However, where there are existing street car or trolley bus lines with fixed facilities already in place, every effort should be made to include them in the system.

An interesting means of developing a rapid-transit system is being used in Gothenburg, Sweden, a city with a population of 350,000. A street-car system is being built in the new suburbs over grade-separated rights-of-way to rapid-transit standards. Eventually these street-car lines will be joined together to form a complete rapid-transit system with underground lines in the central area.[38]

Stations.--The location of stations is as important to urban development as the location of lines. Wider spacing encourages suburban development between stations, and at the same time promotes the use of the automobile as a feeder vehicle for a large proportion of transit riders. The planned extension of Cleveland's rapid-transit system will have two

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[38]John I. Williams, "Coordinated Urban Transport Planning in Scandinavia," Traffic Engineering, Vol. 29, No. 12, September, 1959, p. 15.

stations one mile apart, with automobile parking for 1200 and 1400 automobiles respectively. This is 50 per cent more parking space than is available on the 13 miles of existing rapid transit.[39]

Where a line goes through areas of alternately thick settlement and relatively open space, stations with large parking lots should be located in the sparse areas. If this is done, built-up land will not be sacrificed for parking lots, and extensive parking facilities will be located where they are easiest to obtain. Furthermore, the development of the largely vacant areas will be encouraged. Land for outlying stations and parking lots should be reserved in advance. These are as essential as the rights-of-way themselves.

No method of station-spacing fits all conditions, and each situation must be separately assessed. The closer the spacing of stations, the slower the over-all speed. Where this is not a handicap and dense urban development along the line is desired, stops should be no further than one half mile apart. In the central business district three or four stops to the mile should be provided.

While stations should afford protection from the weather, they need not be elaborate; however, a community served by a particular station may desire to make it distinctive. With imagination, a station and surrounding area

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[39]Hyde, op. cit., p. 141.

could be planned as the focus of a small community. At certain stations planned "rapid-transit districts" could be established, in which, subject to approval of zoning authorities, a variety of functionally related activities would be permitted.

Service standards.--The terms "speed" and "convenience" are relative. Implied is a comparison, generally with the automobile at its best, on good highways with no congestion and adequate parking. In setting up standards for rapid-transit service, it is advisable to keep this comparison in mind. Trip-time consumed from origin to destination should be no more than the equivalent trip-time by automobile. Time spent waiting for a train is part of total trip-time, and under most conditions it is better to have trains with fewer cars operating more frequently (shorter headway) than longer trains operating less frequently.

Given a transportation system, land use and population distribution follow, rather than the reverse. Through the creative use of rapid transit, urban development can be guided into patterns of greater municipal efficiency. When there is an over-all policy and over-all planning, rapid transit is an effective agent in the realization of community goals. A properly developed system can channel population distribution, create points around which new industry can decentralize, and reinforce the central business district as the focus of the metropolitan area.

CHAPTER IV

ORGANIZATIONAL AND FINANCIAL ASPECTS OF RAPID TRANSIT

A comprehensive rapid-transit system can only be developed through an organization that is itself comprehensive. This organization must have jurisdiction throughout the metropolitan area, and must be able to coordinate rapid transit with all other means for the movement of people. Furthermore, the public interest requires that the system be developed according to a general area development plan. If a private company controls this development there may be a conflict of purpose. For this reason and because of the heavy capital outlays required, the possibility of deficit operation for a long period of time, and the resulting need for public funds, control of development of the system should be vested in a public agency. The system may be operated by either a public or a private agency. The two types of public agencies most adaptable to the task of providing a service throughout the metropolitan area are the District and the Authority. It is the purpose of this chapter to examine the organizational and financial structure of these bodies, along with their advantages and limitations as applied to rapid transit, and to suggest ways in which their effectiveness may be improved.

Common to the District and the Authority are certain

powers and privileges. Both are exempt from the payment of Federal, state, and local taxes. Both have the power to condemn land and property necessary to the carrying out of their programs. Granted a charter which provides the needed powers, either District or Authority can perform all the functions necessary to proper development of the system. It is in organizational structure and method of financing that the essential differences exist. It is these questions which are decisive in the choice of an organization for rapid transit.

The District

The essential characteristic of the District is the power to issue general obligation bonds and levy taxes. No rapid-transit system is presently operated by a District. However, in the San Francisco Bay Area a District has been established to build and operate a rapid-transit system. The Report of the Commission[1] which recommended the formation of this District served as a major source of information for this section of the thesis.

Although the basic characteristics of the District are the same throughout the United States, the laws of the state or states in which a particular District is to be located will result in variations in the organizational structure and will impose restrictions and limitations on the financial powers.

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[1]Report to the Legislature of the State of California, op. cit.

Organization.--Districts are established by act of the state legislature. In some cases an affirmative vote of the majority of the voters in the District is required for ratification. In other cases a majority of voters in each individual jurisdiction is necessary. Where the jurisdictions to be included in the District petition for its creation, subsequent local ratification is usually not required.

The policy-making body is a Board of Directors representing the various jurisdictions in the District. Many different methods are used to apportion these representatives. The counties in the San Francisco Bay Area District are represented by a Board of Directors apportioned as follows:

1. Counties of 350,000 or less have two Directors, one appointed by the County Board of Supervisors, and the other by a committee composed of the Mayors of the cities in the county.

2. Counties of 350,000 to 600,000 have three Directors, two appointed by the County Board of Supervisors and one by the Mayors.

3. Counties of more than 600,000 have four Directors, two appointed by the County and two by the Mayors.[2]

Under this formula, 16 members comprised the initial Board. The term of office of each member is for four years, with

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[2] Ibid, p. 157.

some of the initial appointments being shortened so that the expiration of terms will be staggered.

A General Manager, appointed by the Board, acts as the chief administrator of the District. This General Manager and a small staff are adequate to conduct the affairs of a newly-formed District. As the rapid-transit program progresses, as rights-of-way are acquired, construction begins, etc., the staff will have to be expanded.

The San Francisco District is empowered to perform all the basic functions of a rapid-transit proprietary agency, including the furnishing of parking facilities, operation of transit feeder services, and use of freeway center malls for rapid-transit lines. However, no specific provision was made in the enabling act for joint development and administration of highway and rapid-transit facilities, and this lack of coordination may eventually act as a hindrance to proper development of the system.

As the metropolitan area grows and extends into new territory, the District may require expansion. In order to annex such territory the District must first obtain the approval of the voters in the areas to be annexed. The San Francisco District may annex new territory only after a majority of the voters of the area in question approve the annexation. An election may be called for this purpose by a County Board of Supervisors or by a petition containing signatures equal to at least 10 per cent of the vote cast in

the most recent general election. With no assurance that annexation will be approved where comprehensive development of the system indicates such need, the District may never realize its full potential. The Boston rapid-transit system, although operated by an Authority, is like the District in its annexation procedure. No local referendum has ever approved extension of the rapid-transit system into territory outside the present limits, and as a result the efficiency and comprehensiveness of the system have been impaired.

Financing.--The primary source of funds for rapid-transit development by a District is the general obligation bond, the payment of which is guaranteed by the District. Districts are empowered to levy taxes to raise funds for the payment of these bonds. The amount of outstanding bonds permitted is limited by law. In the San Francisco District this amount cannot exceed 15 per cent of the assessed valuation of taxable property. The bonds can be used only for acquisition, construction, and completion of rapid-transit facilities and other necessary property, works, or structures.

All general obligation bond issues require voter approval. In the San Francisco District two-thirds of the voters must approve. Although this District has been in existence since 1957, the first bond issue has not as yet been presented to the voters. This first bond issue, if

passed, will provide funds for the first stage of construction: two more phases are planned, each requiring another bond issue. Assuming that ratification is obtained for all three bond issues and the basic system built, new bond issues may be required for extension of services. The initial bond issue will be voted on in 1960, and it remains to be seen whether the voters will approve and whether the District will be able to develop the planned system.

In the San Francisco District a number of taxes including sales, gasoline, income, and property taxes were considered as possible sources of funds. The property tax was the simplest to assess, levy, and collect, and did not conflict with any Federal or State laws. The District, therefore, was empowered to levy two property taxes. The first would pay for the general obligation bonds, and would be levied at two different rates, the higher rate being applied to property within four miles of the facilities. The second tax, levied on the same basis but limited to five cents per one hundred dollars of assessed valuation, would pay for all other District purposes such as administration, engineering and planning studies, and, if fares proved insufficient, to cover operating expenses.

In the early stages of development of a rapid-transit system, tax funds are especially important, since the full potential of revenue from fares will not yet be realized. With the expansion of the system and the growth in ridership,

fares will become the greatest single source of revenue. The enabling act of the San Francisco District specifies that fare rates, insofar as practicable, should be fixed so as to produce revenue sufficient to cover operating expenses, repairs, maintenance and depreciation, and acquisition of rolling stock.[3]

The Authority

The Authority is a public corporation possessing some of the major advantages that are enjoyed by a privately-owned and financed corporation. Normally there are no "profits" from the operation of an Authority, since the basis of operation is service at actual cost. It is customary for income in excess of operating, maintenance, and debt retirement expenditures to be invested in extensions, modernizations, improvement of service, or reduction of charges. Unlike the District, an Authority has no power to levy taxes; it issues revenue bonds rather than general obligation bonds. The rapid-transit systems of Boston, Chicago, and Toronto are operated by Authorities. The Los Angeles Metropolitan Transit Authority and the Delaware River Port Authority are also empowered to construct and operate rapid-transit facilities, and a Federal Authority is planned for transportation including rapid transit in the Washington, D. C. metropolitan area.

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[3] Ibid., p. 165.

Organization.--An Authority is established by an act of the state legislature. Where two states are involved, as was the case with the Delaware River Port Authority (New Jersey and Pennsylvania), joint legislation is required.

There is considerable latitude in the size of the Board of Directors of a rapid-transit Authority, and in the method of selection of its members. Boston's Metropolitan Rapid-Transit Authority has three members, appointed by the Governor; of the seven Board members of the Chicago Transit Authority, three are appointed by the Governor with consent of the State Senate, and four by the Mayor with consent of the City Council. The Delaware River Port Authority has sixteen members, eight appointed by the Governor of New Jersey, six by the Governor of Pennsylvania, and two ex-officio (Pennsylvania Auditor General and Treasurer). Terms of office of the directors of different Authorities vary from four to seven years with staggered terms. The Board of Directors selects a General Manager, who carries out policy in much the same way as the Manager of a District.

The wider the range of activities an Authority is permitted to engage in, the more comprehensive a system it can develop. Provision for coordination between rapid transit and other transportation facilities is particularly valuable. The Authority need not own all these facilities. What is important is its ability to enter into many kinds of agreements with other transportation agencies, public and private.

All Authorities presently operating rapid-transit systems operate other mass transportation facilities; however, none of them has been granted the power to coordinate rapid transit with freeway construction. The proposed Washington, D. C. Authority, although specifically enjoined from acquiring any privately-owned mass transportation facility already existing in the Authority's service area, has a voice in determination of freeway location through joint planning.[4]

To keep pace with the expansion of the metropolitan area the Authority should be able to extend its facilities into new territory. Existing rapid-transit Authorities are circumscribed as to service area. However, voter approval is unnecessary for annexation of new areas by an Authority, and if the charter places no limitations on the service area, expansion of the system can take place wherever proper development indicates the need.

Financing.--Primary sources of funds for an Authority are revenue bonds, fares, and contributions from local governments. The revenue bond is issued on the premise that revenues from the facilities will be adequate to pay both principal and interest. The advantage of this type of financing over the general obligation bond lies in the fact that approval of voters is not required for bond issues,

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[4]Senate Bill S3193, Report No. 1631, Calendar No. 1703, Senate of the United States, 86th Congress, 2nd Session, June 21, 1960, pp. 48, 49.

and the indebtedness incurred is not a part of the community debt.

The traditional concept of rapid-transit fare structure has been one of complete reliance upon fares for all costs, including capital costs. Since rapid transit benefits the entire community, however, it is inequitable to place the whole burden on the riders. Furthermore when a new rapid-transit system is built or when a line is extended into new territory it may be many years before large-scale patronage results, and fares probably will not even pay the operating costs. Therefore fares alone cannot pay for enough revenue bonds to finance the entire system.

To overcome this problem, existing Authorities have resorted to a number of measures. A formula has been worked out between the Chicago Transit Authority and the City of Chicago whereby the city provides the rights-of-way, tracks, and stations and installs all of the fixed equipment, and the Authority repays the city in monthly installments over a period of 30 years without any interest charges. The cost of rights-of-way and stations is not included in the amount repaid to the city. On one three-mile extension which is expected to have light traffic for a number of years, the city will relieve the Authority of any obligations for repayment at least until the revenues justify such payments. The Authority is also leasing two tracks of a six-track railroad line. The cost of needed grade separations

(22 in number) will be shared by the railroad and various governmental and highway agencies interested in the elimination of the grade crossings.[5]

In Toronto the community furnishes rapid-transit rights-of-way in the same manner in which it provides rights-of-way for mass transit. In addition to the rights-of-way for the planned extension of the system, the Metropolitan Council will pay 50 per cent of all other capital costs. The Transit Commission's share will be paid by fares and the community's share by a 2 mill property tax. As in the case of a limited access expressway, the facilities will be paid for by the taxpayers for the use of one segment of the citizenry.[6]

In Boston, part of the rapid-transit system (the Cambridge Subway) is owned by the Commonwealth of Massachusetts, and the Authority pays an annual rental for its use. The Authority serves 14 communities. Funds for any capital improvements to the system are paid for by these communities with the State guaranteeing payment of the bonds. All the fares from the system go into a pool from which the operating costs and interest on bonds is paid. Any deficits are

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[5]Stanley D. Forsythe, "Rapid Transit is Expanding in Chicago," Reprint of an article in Mass Transportation, August, 1956.

[6]W. F. Irvin, "Public Improvements in Toronto," Paper for use in panel discussion at the American Society of Civil Engineers Convention, Cleveland, May 7, 1959 (mimeo), p. 17.

assessed to the 14 corporate communities, the assessment being proportionate to the number of rides originating in each of the communities. This method of assessment, theoretically based on the benefits conferred, conceivably could result in inequities because a community least able to pay might have a high proportion of riders. Other methods which could be employed to distribute the costs are: assessment by population, assessment by number of miles of rapid-transit lines in the community, etc. Probably the most equitable basis for assessment, however, is ability to pay. This method places reliance on the total valuation of property in the political unit.

If a rapid-transit Authority operates many different kinds of transportation facilities, those which are "profitable" can be used to sustain those which are "unprofitable." In Chicago, for example, operation of the surface transit lines helps to support the rapid-transit lines. The Delaware River Port Authority owns the Philadelphia-Camden rapid-transit line as well as three toll bridges connecting New Jersey and Pennsylvania, and port facilities. The enabling act which created this Authority provides that any surplus revenues from bridge tolls or port facilities may be used for the construction of rapid-transit facilities. The Port of New York Authority, unlike the Delaware River Port Authority, does not include rapid transit in its transportation system. Instead, its activities have been

concentrated primarily on construction of toll bridges and tunnels. The large surpluses resulting from these activities have been constantly reinvested into new facilities for the automobile, competing rather than coordinating with rapid-transit facilities.[7] This Authority was originally set up to provide comprehensive metropolitan transportation facilities. If it should take over the job of furnishing rapid transit within the New York-New Jersey metropolitan area, "a comprehensive and rational plan that does not perpetuate the present disparities might be achieved."[8]

A rapid-transit system can be developed by either a District or an Authority. Both of these agencies are created by the state. The District, however, is subject to a greater degree of local control, while the Authority has greater freedom of action. Regardless of the organization, some financial support must be obtained from the community as a whole.

The experience of the San Francisco District may demonstrate the feasibility of the District form. At present,

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[7]Theodore W. Kheel, "The Self-Sustaining Fare is Self-Defeating," A Report on the Inseparably Inter-Linked Problems of Transit and Traffic and a Suggested Solution (privately printed, 477 Madison Avenue, New York), nd, (mimeo).

[8]Harrison E. Salisbury, "The Commuter Crisis," The New York Times, March 4, 1959.

however, an Authority which equitably distributes the costs of the transit services, operates a balanced transportation system throughout the metropolitan area, and is empowered to expand services as needed, appears to be the most effective instrument for development and operation of metropolitan rapid transit.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Provision of a basic network of rapid-transit service is one of the ingredients of economic health and well-being for any large metropolitan area. Complete reliance upon automobiles and local transit can no longer suffice to meet the growing demand for passenger transportation. Rapid transit furnishes an alternative to the compulsory use of these existing transportation media. For the metropolitan area of today, a new kind of rapid transit is needed, different from systems constructed in the past. The two most important features of this modern rapid-transit network must be its coordination with the automobile and all other forms of local and commuter transit, and its comprehensive coverage of the entire metropolitan area.

Rapid transit accomplishes more than merely providing a service for existing transportation needs. The facilities have a powerful effect on the pattern of urban development, and can be utilized to guide future growth. Only when there are an over-all plan and generally accepted community goals, can rapid transit be effective as a tool for accomplishing these objectives. The attainment of community goals cannot be achieved through technical means alone. Public debate should play a vital part in their formulation.

Since the entire community benefits from rapid transit, an equitable division of costs should be made. The passenger through the fare, the owner of benefited property through special assessments, and the public at large through property taxation, can share this cost.

Without rapid transit, the costs of providing facilities for automotive movement will place an ever-greater financial burden upon all agencies which bear responsibility for urban highways. If the state and Federal governments recognize an obligation to aid in the furnishing of highways, they should, by the same token, accept a portion of the responsibility of supplying rapid transit. This form of transportation serves more people per dollar invested, and, in the long run, is less of a drain on financial resources. State and national highway programs, coordinated with metropolitan rapid-transit programs, would aid immeasurably in resolving the metropolitan transportation problem.

The necessity for studies and research in rapid transit is becoming more apparent as automobile congestion increases and more metropolitan areas begin considering rapid transit. The problem of metropolitan area transportation is national in scope. The Federal government, therefore, should cooperate with local governments by providing grants-in-aid, matching funds, and a research program for rapid transit. Legislation to accomplish these purposes is pending in the Congress of the United States. The major

political parties have recognized the need for such legislation in their 1960 platforms.

BIBLIOGRAPHY

Analysis of Underground and Overhead Passenger Conveyor System for Downtown Cincinnati, City of Cincinnati, Department of Public Works, Division of Engineering; Cincinnati, 1955.

Arnold, David S., "Financial Problems of Urban Transit Systems," Public Management, Vol. 38, No. 9, September, 1956.

Bailey, John A., "Transportation in the Philadelphia Metropolitan Region," City of Philadelphia Urban Traffic and Transportation Board, Philadelphia, 1959 (mimeo).

Berge, Stanley, "New Horizons for Commuter Service," quoted in Going Places, Vol. 1, No. 4, July-August, 1958.

Bettman, Alfred, City and Regional Planning Papers, (Cambridge, Mass., 1946).

The Big "T" for Employers, Chicago Transit Authority, Chicago, 1959.

Booth, James and Morris, Robert, "Transit Versus Auto Travel in the Future," Journal of the American Institute of Planners, Vol. 25, No. 2, May, 1959.

Brinckerhoff, H. M., "The Effects of Transportation on the Distribution of Population in Large Cities," Proceedings of the 13th National Conference on City Planning, Pittsburgh, 1921.

Chicago Daily Tribune, February 17, 1958.

"Cities Strive to Rid Autos, Buses of Fumes Polluting Atmosphere," Washington Post and Times Herald, Washington, D. C., November 8, 1959.

Claire, William H., "Urban Renewal and Transportation," Traffic Quarterly, Vol. 12, No. 3, July, 1959.

Congressional Record, 86th Congress, 2nd Session, Vol. 106, No. 56, March 28, 1960.

Crosstown and Bypass Expressways, Expressway Policy Study No. 2, Metropolitan Planning Commission, Atlanta, 1959.

Damon, George A., "Inter and Intra Urban Transit and Traffic as a Regional Planning Problem," Proceedings of the Fifteenth National Conference on City Planning, Baltimore, 1923.

Determination of Potential Rapid Transit Routes, A Study of Public Transportation Needs in the Area Served by the Los Angeles Metropolitan Transit Authority, (Coverdale and Colpitts), New York, 1959.

Douglas, Walter S., Proceedings of the National Conference Co-ordinating Metropolitan Area Transportation, Chicago, 1957.

Ely, Richard T. and Morehouse, Edward W., Elements of Land Economics, (New York, 1932).

Forsythe, Stanley D., "Rapid Transit is Expanding in Chicago," Reprint of an article in Mass Transportation, August, 1956.

Greeley, Roland B., "Transportation Planning, an Essential Part of Any Comprehensive Planning," Traffic Quarterly, Vol. 12, No. 1, August, 1959.

Hauser, Philip M., "The Challenge of Metropolitan Growth," Urban Land, Vol. 17, No. 11, December, 1958.

Hoyt, Homer, Structure and Growth of Residential Neighborhoods in American Cities, (U. S. Government Printing Office, 1939).

Hyde, Donald C., Proceedings of the National Conference Co-ordinating Metropolitan Area Transportation, Chicago, 1957.

Irvin, W. F., "Public Transit Improvements in Toronto," Paper used in panel discussion at American Society of Civil Engineers Convention, Cleveland, 1959, (mimeo).

Kearns, E. E., "Coordinated Transportation for Large Metropolitan Communities," Paper presented at the American Institute of Electrical Engineers Winter General Meeting, New York, 1952.

Kheel, Theodore W., "The Self-Sustaining Fare is Self-Defeating," A Report on the Inseparably Interlinked Problems of Transit and Traffic and a Suggested Solution, (privately printed, 477 Madison Avenue, New York), nd, (mimeo).

Land Planning Considerations in the Washington Metropolitan Area, Staff Study prepared for the Joint Committee on Washington Metropolitan Problems, compiled by Charles W. Elliot (U. S. Government Printing Office), 1958.

Lapin, Howard S., "Costs of Excessive Congestion in Philadelphia," Traffic Engineering, Vol. 27, No. 12, September, 1957.

Lessing, Lawrence, "Sick Transit: The City's No. 1 Problem," Architectural Forum, Vol. 110, No. 1, January, 1959.

Local Planning Administration, (2nd Ed.), International City Managers Association, (Chicago, 1948).

Mass Rapid Transit Answer to Traffic Congestion in the San Francisco Bay Area, Report of the Senate Interim Committee on San Francisco Bay Area Metropolitan Rapid Transit Problems, San Francisco, 1953.

McCallum, E. F., "What's Ahead in Transit," Traffic Safety, Vol. 56, No. 1, January, 1960.

McConochie, William R., "Freeways Can Save Urban Transit," Urban Land, Vol. 16, No. 8, September, 1957.

Metropolitan Rapid Transit Survey, Report of the Project Director to the Metropolitan Rapid Transit Commission, New York, 1957.

Mitchell, Robert B. and Rapkin, Chester, Urban Traffic, a Function of Land Use, (New York, 1954).

"Motor Vehicle Use Studies in Six States," Public Roads, Vol. 28, No. 5, December, 1954.

National Capital Transportation Act of 1960, Hearings before the Joint Committee on Washington Metropolitan Problems, 86th Congress, 2nd Session, Pursuant to S. Con. Res. 101 on S3193 and H.R. 11135, May 5 and 6, 1960, U. S. Government Printing Office, 1960.

Owen, Wilfred, Cities in the Motor Age, (New York, 1959).

Plan and Program 1955, Urban Traffic and Transportation Board, City of Philadelphia, Philadelphia, 1956.

Plan for a High Speed Mass Transit System between Philadelphia and Camden and South Jersey Suburbs, City of Philadelphia Urban Traffic and Transportation Board, Philadelphia, 1959.

Plan for South Philadelphia Subway Extension, Department of Public Property, City of Philadelphia, nd.

Preliminary Financial and Organizational Report Regarding Metropolitan Transportation, Joint Committee on Washington Metropolitan Problems, 86th Congress, 1st Session, (U. S. Government Printing Office), Washington, D. C., 1959.

Preliminary Report, San Francisco Bay Area Rapid Transit Commission, San Francisco, 1953.

Rapid Transit for the New York-New Jersey Metropolitan Area, Report of the Metropolitan Rapid Transit Commission, New York, 1958.

Rapid Transit in Six Metropolitan Areas, Staff Report Prepared for the Joint Committee on Washington Metropolitan Problems, U. S. Government Printing Office, Washington, D. C., 1959.

Regional Rapid Transit, A Report to the San Francisco Bay Area Rapid Transit Commission, San Francisco, 1956.

Regional Survey of New York and Its Environs, (New York, 1931), 8 Vols.

Report of the Committee on Rapid Transit, No. 106, Proceedings of the American Electric Railway Association, New York, 1928.

Report of the Street Railway Commission of the Rapid Transit Commission to Honorable John C. Lodge, Mayor, Detroit, 1929.

Report on Improved Transportation Facilities in the Boston Metropolitan District, Division of Metropolitan Planning, Commonwealth of Massachusetts, Boston, 1926.

Report to the Council of the Municipality of Metropolitan Toronto on East-West Rapid Transit Proposals, Appendix "E", Building Developments and Increased Assessments in the Area Served by the Yonge Street Subway, Toronto Transit Commission, Toronto, nd.

Report to the Legislature of the State of California, San Francisco Bay Area Rapid Transit Commission, San Francisco, 1957.

Rossell, W. T. and Gaul, David Q., "Rapid Transit's Value to a City," Traffic Quarterly, Vol. 10, No. 1, January, 1956.

Salisbury, Harrison E., "The Commuter Crisis," (Series of three articles), The New York Times, March 4, 1959.

Schnore, Leo F., "The Timing of Metropolitan Decentralization," Journal of the American Institute of Planners, Vol. 25, No. 4, November, 1959.

Schroeder, Werner W., "Metropolitan Transit Research Study," Chicago Transit Authority, Chicago, 1954.

Seaside Rockaway, Slum Clearance Plan under Title I of the Housing Act of 1949, New York, 1954.

Seibert, Paul W., "Bay Area Preparing to Invest $1 Billion in Rapid Transit," Going Places, Vol. 1, No. 6, November-December, 1958.

Senate Bill S3193, Report No. 1631, Calendar No. 1703, 86th Congress, 2nd Session, June 21, 1960.

Service Standards and Equipment for Mass Transit, Technical Memo No. 5, City of Philadelphia Urban Traffic and Transportation Board, Philadelphia, 1955, (mimeo).

Spengler, Edwin H., Land Values in New York in Relation to Transit Facilities, (New York, 1930).

Stichman, Herman T., "Analysis of the Obligation and Ability of the Port of New York Authority to Help in Improving New Jersey-New York Rail Commutation," Hudson and Manhattan Railroad Company, New York, 1959.

Street Traffic Management for Los Angeles, A Report of the Los Angeles Traffic Survey Committee, Los Angeles, 1948.

Streets and Transportation in Youngstown, Report No. 8, Youngstown Comprehensive Plan, Youngstown, Ohio, 1952.

A Study of Traffic and Transportation in Metropolitan Dade County 1958, Department of Traffic and Transportation, Miami, 1958.

Tennyson, E. L., "Moving People in Urban Areas," Planning, Proceedings of the Annual National Conference of the American Society of Planning Officials, Chicago, 1953.

Thompson, Francis R., Electric Transportation, (Scranton, 1940).

Transportation Plan for the National Capital Region, Hearings before the Joint Committee on Washington Metropolitan Problems, on Report of the Washington Mass Transportation Survey, 86th Congress, 1st Session, November 9 through 14, 1959, U. S. Government Printing Office, Washington, D. C., 1960.

Transportation Plan, National Capital Region, National Capital Planning Commission and National Capital Region Planning Council, Washington, D. C., 1959.

Transit in Toronto, Toronto Transit Commission, Toronto, nd, (mimeo).

Van den Hagg, Ernest, "Creating Cities for Human Beings," The American Scholar, Vol. 28, No. 4, Autumn, 1959.

Washington Metropolitan Area Transportation Problems, Hearings before the Joint Committee on Washington Metropolitan Problems on Transportation Problems in Maryland, Virginia, and the Washington Metropolitan Area, 85th Congress, 2nd Session, May 22, 23, and June 10, 1958, U. S. Government Printing Office, Washington, D. C., 1958.

Webber, Melvin M., "The Engineer's Responsibility for the Form of Cities," Traffic Engineering, Vol. 30, No. 1, October, 1959.

West, M. H., "San Francisco Bay Area Transportation, 1960," Traffic Engineering, Vol. 30, No. 4, January, 1960.

Williams, John I., "Coordinated Urban Transport Planning in Scandinavia," Traffic Engineering, Vol. 29, No. 12, September, 1959.